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Examining Perceptual Defense Using the Stroop Test of Interference with Taboo Words

by

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A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled: "Examining Perceptual Defense Using the Stroop Test of Interference With Taboo Words," submitted by David Millar Keyes in partial fulfillment of the requirements for the degree of Master of Education.

ABSTRACT

Color naming latency (CNL) and color recognition thresholds (CRT) were investigated. A tachistoscop presented colored word stimuli at different exposure times. In Experiment I (to investigate subliminal perception), 10 subjects acting as their own controls, reported when they could first see color from a tachistoscopically presented stimulus. This speed was noted as the color threshold of the individual stimulus. Forty-eight such measurements were made. In Experiment II (to investigate perceptual defense), these same 10 subjects had to say the color seen from a stimulus presentation as quickly as possible. This response was spoken into a tape recorder. The subjects responded in an appropriate manner to all 48 stimuli shown, at five different presentation durations. The recorded tape qas magnetically fed into a recording polygraph, such that an electronic beep, triggered by the stimulus presentation caused a pen deflection. Another deflection of the pen came as a result of the voiced response. Color naming latency (CNL) was then measured as the distance between the presentation deflection and the voiced color response deflection. Four different treatments of the stimuli resulted in a comparison being possible between taboo words, neutral words, Stroop words and patches resembling words. Four different colors were presented. The colors presented were red, blue, green and yellow. No indication of subliminal perception was evident in Experiment I. There was no significant difference found between the various treatment groups in Experiment II. However, a significant difference resulted in CNL among the duration presen-

tations (L) for Experiment II indicating subjects treated the stimuli differently at different speeds for both I and II. A significant difference noted among the colors was most likely due to improper color masking. This allowed one color to be seen easier than another color.

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CONTENTS

PAGE

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

INTRODUCTION

The term perceptual defense was first used by Bruner and Postman (1947), in describing the results of their experiment, investigating the relationship between taboo stimuli, emotionality, and tachistoscopic recognition threshold. More recently, Brown (1961) in referring to the term described it more generally as any systematic relationship between the emotion arousing properties of a stimulus and recognition threshold.

Spence (1967), argues that researchers must be more broad in their approach to the defense phenomena, and must consider it as a problem with two sides; subliminal perception and perceptual defense. A stimulus may register outside of awareness and bring about a change in perceptual sensitivity (subliminal perception); the same stimulus could then bring about a change in response (perceptual defense).

Taylor, Forest and Derek (1966), interpret perceptual defense as an example of "set" such that, when taboo words are not seen, it is because a set to see something else is in operation. Similarly, Pettigrew, et al., (1958), stated that perceptual defense arises when culturally less familiar images are suppressed over culturally more familiar images. Their work involved subjects of different races in South Africa and attempted to find out if perceptual defense existed with regard to the color of the skin. Subjects were asked to name the race of the face seen. Positive results were obtained, as subjects recognized their own race most of the time, and races never saw " lower " socio-

economic races than themselves, but always saw a group above them in the socio-economic framework. Other researchers saw perceptual defense occurring because subjects could see taboo words sooner, due to the similarity in letter composition. They could guess using form analysis (Bricker, 1958). For example subjects would guess at the word from seeing its form rather than truly seeing the individual letters making up the word. Taboo and neutral words must then be equated as to their form as well as their length if this variable is to be removed.

The Problem

From recent research, it appears that subliminal perception and/or perceptual defense have never been fully analysed and examined in the laboratory. Do they really exist or are they merely terms describing a hypothetical phenomena? The present study was undertaken to examine how subjects perceive different word stimuli. Can subjects perceive stimuli below a threshold level without being aware of perceiving (subliminal perception)? When word information is subliminally available, do subjects employ a defensive block against conscious awareness of stimuli that are of a taboo nature?

It is important to examine both subliminal perception and perceptual defense together (Spence, 1967) using the same subjects. The present study uses two interlocking experiments such that subjects can be tested and retested using the same procedural test.

The study investigated color recognition threshold and color naming latency to colored stimuli shown via a tachistoscope. The stimuli were taboo, neutral and Stroop words. Color patchs were also presented as a control.

In Experiment I, a subject was required to say the color seen

when she first recognized it. The threshold color response was thus determined for 48 stimuli. Subliminal perception would be indicated by the taboo treatment having a significantly lower threshold mean than the neutral treatment mean.

In Experiment II, a subject was required to say the color of tachistoscopically presented stimuli as quickly as possible. Five presentation durations were given for all the stimuli. The entire 48 stimuli were shown in a randomized order to all the subjects and all the subjects saw a different random order. When a subject had responded to the color seen for all the stimuli at one speed, she then saw the same order of stimuli at another duration. In this manner, all five presentation durations were given for all the stimuli.

Perceptual defense would be indicated by the taboo treatment having a significantly lower CNL (color naming latency) mean than the neutral treatment CNL mean. Word information increase effects can be analysed by examining the CNL mean for the different presentation durations. As more and more word information becomes available, subjects should treat the treatment groups differently. Taboo treatment means should be lower than the matching neutral and Stroop treatments at the fastest presentation durations, if subjects employ complete perceptual defense. This relationship could change as more word information becomes available, and subjects employ partial perceptual defense. This causes word interference to raise the CNL mean. Color patches should offer no word information and should have the lowest CNL mean at all presentation durations. The Stroop treatment should offer the greatest word interference effect due to the conflicting color-word information available. Subjects should not use perceptual defense in blocking out word information

for this treatment, as the presence of the words does not threaten them. This word interference effect will cause the Stroop treatment to have the highest CNL mean at all presentation durations. This should even be true for the longest duration, as the taboo treatment will be lower, due to the subjects employing partial perceptual defense to shield total word information.

In combining Experiments I and II, the same subjects can be analysed for evidence of subliminal perception and perceptual defense (Spence, 1967). This study then is to examine the two interacting phenomena together, yet separate them for individual analysis. It may be noted that the following criteria of Spence (1967) were also met.

1. The subjects were aware of the stimuli and could not concentrate elsewhere due to the direct observation setup of the tachistoscope.
2. The experiment was relevant to the subjects as the importance of the research to the examiner was stressed.

Review of the literature

Early Studies

Evidence for the perceptual defense phenomena dates back several years, and covers a wide range of experiments and theories.

An early study by McGinnies (1949), pointed out that perceptual defense appeared to be based upon conditioned avoidance of unpleasant or dangerous stimuli, or in a narrower sense, upon an avoidance that resulted from learning tasks (we see what we have learned to see). Substantial evidence has come from Walters, et al., (1959), that this is so. They required subjects to report neutral words that were presented by a tachistoscope at the previously established exposure time thresholds. They

found that other conditions being equal, nontaboo words that immediately follow subliminally presented taboo words will be correctly identified less often than neutral words that follow subliminally presented neutral words. This experiment can be under question, due to the fact that the person's duration threshold will not remain steady but will fluctuate with time. The same is also true of a replication study done by Walters and Pilipec (1964), using female, instead of male subjects.

Silverman, et al., (1966) however reported significant findings of subliminal aggressiveness reflected in clinical phenomena. Psychiatric male patients were presented stimuli on hand held cards that were of the following types:

1. subliminal aggressiveness compared against:
   a. sibliminal neutral, e.g.: a picture of a man with a pleasant expression and his hand positioned as if he were greeting someone;
   b. subliminal libidinal, e.g.: a picture of an attractive, nude, buxom female in her twenties;
   c. supraliminal (above subliminal) aggressive, e.g.: menacing looking man with a dagger in his upraised hand and his teeth bared.

The patients were given a Rorshcharch both before and after viewing the stimuli. From these, their behavior was categorized into clinical patterns of known deviations. This study may fail to give true population results by using a biased sample. The reported literature warns against using hospital patients because of their particular personality attributes which separate them from the general population. However we may note that even though the patients could not see the stimuli, their

behavior was changed. Feasibly, this was due to subliminal perception.

Lerner (1966), reports evidence in support of perceptual defense using anal and neutral words with stamp collectors. This seems to shed light on the possibility that certain people react to certain types of taboo, aggressive or anal words versus neutral words.

Miller and Solkoff (1965), reported a sex difference on recognition thresholds for neutral and taboo words. They reported men have a significantly higher recognition threshold for spoken taboo words when they are identified by speaking, than for written identification. Women showed no difference in thresholds.

Dorfman, Grossberg and Kroeker (1965), used only female subjects in an experiment on recognition. Subjects were to utter words seen via a tachistoscope that could be either a taboo or a neutral word. Subjects reported more neutral words correctly than taboo words at all exposure time durations. Goldstein (1966), however failed to confirm the findings of Dorfman, et al., and had instead found considerable stability for recognition accuracy and correct response across the exposure duration range. Subjects had an equal chance of guessing the word correctly as incorrectly, at any exposure time, as the word would be either neutral or taboo.

Fiss (1966), reported that subjects should be conscious of their own hostile feelings and thoughts before reacting to subliminal stimulation. This would relate their feelings to the experiment and increase perceptual defense to aggressive words. If this was not done, subjects seemed not to notice words which had a lot of " feeling " for them, and seemed to have detached their feelings from action. It would seem that if subjects do not concentrate on the experiment (take an active interest), then perceptual defense is not confined to special words, but may instead

be present over the entire experiment or completely absent.

Recent Work

Most recent research tends to support perceptual defense, while several studies have lead to neutral findings such as the following. Livinton (1968), reported that two subject groups responded identically to crash-and-neutral-word stimuli. Twenty-five sports car drivers (experimental group), and twenty bowlers (control group), were tested before and after participation in their respective contests by reading the crash-and-neutral-word list. A neutral-word list served as an internal control. Subjects also rated the stimulus words on an emotionality scale. They then rated their own sports performance and filled out a questionnaire on death.

The lack of positive results here does not argue against perceptual defense but indicates a further study is needed using different groups of people.

Kipp, et al., (1968), report work with the physically disabled and normal subjects in perceiving pictures, (showing normal subjects and disabled subjects with the same disabilities as their own) shown tachistoscopically. For instance, it was found that a subject who had a similar disability as was pictured on the stimulus card, but who had lost his perception of not being different, could accept physiotherapy more effectively than a subject who had no perception of being different.

Sales and Haber (1968), postulated that it was easier to see frequent words than rare words, and most difficult to see taboo words. They believed that this was due to some emotional content of the taboo words, or as in a preceding experiment, Haber (1965), that it was due to the words having some special meaning for the subjects.

Later, Weintraub, et al., (1968) believed it premature to conclude that perceptual defense plays a role in the visual detection of

words. His study, concentrated upon materials involving dark adaptation to taboo and neutral stimuli. Weintraub et al., (1968) have concluded that the short dark-adaptation times necessary, and the large visual angle employed, lead to incomplete perceptual summation. Rapid sensitivity changes in the beginning moments of dark adaptation, may also have lead to the effects reported.

A survey of the related research reveals that the term perceptual defense is disputed and that there are claims that the defense phenomenon may only appear in the laboratory. It would appear that we may be asking the wrong questions of data, and therefore, getting wrong answers. For example, does a hesitancy to see taboo words necessarily mean the person is defending against its presence? It may be the unexpectedness of the word that causes delay. Evidence offered to disclaim perceptual defense comes from Haas (1963) who postulated that defense as seen in the laboratory, arises from learning. In his study, he found that recognizability was dependent upon the type of verbal reinforcement associated with particular groups of words. All subjects (N=72) participating in the experiment were given a period of learning during which time particular verbal emissions were variously reinforced. Second, following the learning period, the recognizability of selected critical words was measured, i.e., their visual thresholds were obtained. For convenience, these two aspects of the research were designated the learning period and the threshold period. The subjects were rewarded by the experimenter saying right or punished by saying wrong after the relevant emission. From this Haas demonstrated that the frequency of verbal emissions changes following reinforcement. Many variables seemed to have been ignored here, such

as change in visual threshold with changes in light intensity.

Has perceptual defense come about from using rude words as shock stimuli whose analysis cannot be further explored due to the loss of shock and unexpectedness ? Spence (1967), believed this to be untrue as he found experimentation to be the fault of most studies. He saw a need for a study that would look at both perceptual defense and subliminal perception, as he believed that nonrecognition of the subliminal stimulus was due to a subliminal perception of the word leading to active perceptual defense against its presence. A new study of perception must find what effects a nonrecognized word has on the subject, rather than the old methods which only found that it was not recognized. Spence set up criteria that must be met before a defense mechanism can be looked at.

These were:

1. The subliminal stimulus will not produce an effect on an unprepared subject (this would hint that the subject must be aware or alert to effects). This may arise as the subject may be looking elsewhere and not see the stimulus.
2. The stimulus must be relevant to the subject in some fairly obvious way.
3. The stimulus must be maintained over time (must be stored on a memory circuit and have continual relevance to the subject).

Spence would have any experiment, that looks at perceptual defense by using taboo words, follow two simple steps in their procedure before actual testing is begun. We must:

1. Look to see that discrimination is poorer for taboo words over their matched controls. (perceptual defense).
2. Look for evidence of delayed effect of the word itself. This is to see if the delay is caused by the makeup of the words themselves that makes them harder to say. It may be that the taboo word contains a hard to recognize combination of letters.

Spence's outline for a comprehensive examination of perceptual defense and subliminal perception is partially followed by the 1968 study of Sales and Haber, with taboo words. Using prepared alert subjects, they reported a perceptual defense effect evident on the first flash of the word. This is an indication that a perceptual defense mechanism is indeed present and easy to observe as long as the subject is alert to the stimulus.

Relevant Stroop Test Research

Klein (1964) conducted an experiment using the Stroop Test, that is relevant to this experiment. He noted that the greater the tendency to read the word, the harder it was to name the color. This now should apply to the fact that if perceptual defense is defined as before, taboo words in color will be named sooner due to the fact that the word will not be perceptually seen, and a one response, one channel operation will result.

Klein tested two theories, the first of which looked to see if interference came about by two responses being available while having only one response-channel. Six conditions were arranged as follows:

1. Nonsense syllables
2. Rare English Words
3. Common English Words
4. Words implicating color i.e., lemon
5. Different words of the same class, i.e.,

tan, purple etc.

6. Stroop words, i.e., green written in red ink printed in block type. They then named colors on a page of colors alone. The experimental page (colors in the context of letters and words) was then read. All subjects were told to ignore the words while speed and accuracy were emphasized. Errors and reading faults were noted while reading time was recorded every two lines.

Significant differences were noted among the six conditions and increased as a positively accelerated function of the semantic gradient in the order listed above. Therefore, nonsense syllables offered the least interference while the Stroop words gave the greatest interference.

Klein's (1964) second experiment was conducted to see if color-naming delay is indeed produced by the necessity of holding back a competing response. Subjects read aloud as quickly as possible, both the word and color of each color-word unit, and again in reverse. In other words, the subjects said word-then-color and then color-then-word.

Significant results were found as color-then-word took longer to read than word-then-color. Therefore, when the word as such is allowed to come out first, the interference effect is minimized. It would be safe to then say that interference comes from the word and overcoming the desire to say it. Klein described this effect as the subject having two responses, but only one avenue of expressing them, causing one word response to be held in check, (noted by increased response time).

Klein's (1964) study is the only reported experiment that attempted to manipulate the interference effect by varying the verbal text in which the colors are imbedded. The present experiment will also vary the verbal text, by the use of taboo, neutral and Stroop words.

Jensen (1965), reported that the subject who experiences least interference on the Stroop, is characterized as a stable, non-neurotic extrovert. This would tend to agree with the observation that good vocabulary is linked with introversion, and therefore, introverts tend to read the word rather than name the color. A complete investigation into this statement may be made at a later date. The present study will not concern itself with this information as subjects will be randomly chosen nursing student volunteers.

METHOD AND PRECEDURES

The Sample

5 student nurses from the Royal Alexandra Hospital and 5 student nurses from the University of Alberta Hospital were chosen at random from a volunteer list. The subjects mean age was 19.9 years (18 - 24). Subjects acted as their own controls. All participants in this study were female.

Half of the subjects were tested in a small study room at the Royal Alexandra Nursing School, while the other half were tested in the psychiatric research laboratory of the Clinical Sciences Building at the University of Alberta.

Apparatus

The apparatus for presentation and collection of data consisted of a Farrall 3 field, Timer controller model TC-2 tachistoscope in conjunction with a Sony-o-matic tape recorder. A pulse generator was activated by the tachistoscope start button. The pulse was sent to the auxillary input of the tape recorder. The connections were arranged in such a manner that an electric pulse occurred when the stimulus was presented and was recorded on the same track of the tape recorder as the subject's voice.

For Experiment II, a microphone was situated near the subject's mouth. The tape recorder tapes were then replayed, connected to a Chart Recorder (Brush Instruments, Mark II). The chart speed was 25 mm/sec.. When this material had been transferred to the chart paper, measurements were made as to the number of centimeters that separated the presentation pulse (CNL) from the voiced response pulse. This was then the color naming latency (CNL) for any

particular stimulus.

The 48 colored words and patch stimuli (See Appendix B) were printed on standard size tachistoscope presentation cards which were specially adapted for this study. Four colors (red, blue, green and yellow) were used so that twelve words were written in each of the colors. The words were composed of standard Gothic printed rub-on Letraset colored letters, 1.2 mm high. As Letraset does not make a green set of letters, these were cut by hand, from green Letrafilm to conform to the correct size. The Letraset letters were put on various shades of grey background cards to obtain a brightness contrast match between letter and background. Neutral density Letrafilm was then placed over the letters until all of the colors were closely matched to each other for brightness. This level was established by using a Spectra Brightness Spot meter. The following measurements of relative brightness of the four color stimuli were recorded in foot-lamberts:

Red: 7.8

Blue: 5.4

Green: 4.0

Yellow: 3.7

The stimuli were organized into three different lengths (N). If this were not done, certain words would have been distorted. Having stimuli of different length would not give clues to their recognition in this study as treatments were matched for stimulus length.

The Method

The subject was seated with her face pressed snugly into the rubber face plate of the tachistoscope, such that she could see only the stimuli, when they were presented.

The size of the viewing window was cut down reducing the angle of incidence. This was accomplished by putting strips of black velvet around the operative opening, leaving a small square in the middle the size of the largest stimulus presented.

The instructions to Experiment I (see Appendix A), were then read to the subject. Questions were answered to reassure the subject of the experiment to her and to the researcher (Spence, 1967).

The signal " ready " preceded the actual presentation. The duration speed was quickly and easily manipulated on this particular Farrall model tachistoscope. Speeds from 0.001 seconds to 9.999 seconds were possible, but the master intensity was such that the visual threshold would occur around 0.020 seconds.

In Experiment I, a random presentation of the 48 stimuli was given. An increasing duration time (in increases of 0.002 sec.) was presented for each stimulus until the subject reported the color seen. This was then recorded as the color recognition threshold of the particular stimulus (See Appendix B). Experiment I took approximately 20 minutes.

Instructions were then read to the subject for Experiment II (See Appendix A). All 48 stimuli were then presented in a random order at one of the five preplanned duration times, (1.0, 0.30, 0.17, 0.10, and 0.05 seconds). Subjects were divided evenly in the order at which duration times were presented. Five subjects saw the stimuli from the fastest to the slowest duration times (L_1 - L_5), while the remaining five saw the reverse order of presentation, (L_5 - L_1). This was done to eliminate fatigue effects which might be present. Experiment II took approximately 25 minutes.

At the conclusion of the experimental session, all the subject's questions were answered concerning the experimental procedure. Subjects were also encouraged to present their views concerning the experiment, and whether or not they found any of the words taboo.

The Scoring

In Experiment I, the exposure duration that was necessary to see a color was recorded as the color recognition threshold of a particular stimulus. This was recorded at the time of presentation (See Appendix B). In Experiment II, 240 measurements were recorded for each subject (5 measurements per word times 48 words). These 5 measurements represented the 5 duration times.

Analysis of Data

The dependent variables in this experiment were color recognition threshold (Experiment I), and color naming latency (CNL) (Experiment II). The independent variables were : (N) length of stimulus; (C) color (red, blue, green and yellow); (T) treatment) taboo, neutral, Stroop and color patches); (L) presentation durations (0.05, 0.10, 0.17, 0.30, and 1.0 seconds).

33 missing data were first punched onto IBM cards as a 9.00 value with a program that would ignore these values. The card pack was then reinserted with the correct means of the missing data points punched onto the cards. This then gave an error term that could be used to find "F" values (See Experiment II), to a 3 x 4 x 4 x 5 repeated measures factorial analysis of variance. Repeated measures on all the variables were made by each subject.

Results

Visual inspection of the raw data for Experiment I, indicated that the mean scores for the treatment categories supported the predications made, that is, that subliminal perception is present in subjects and they can respond to some stimuli before verbally reporting recognition of those stimuli.

Visual inspection of the raw data for Experiment II, indicated that the predications were not fully supported. That is, that different treatment groups did not affect CNL, but that CNL was significantly affected by different duration times.

Experiment I (Color Recognition Time)

Color recognition thresholds for the 48 stimuli were submitted to a 3 x 4 x 4 repeated measures factorial analysis of variance. A pooled estimate of the error variance was used to give a more powerful test of significance. The grand mean was 0.020096 sec. Table 1 and 2 present a summary of the variance.

Recognition Time (N) length

The presence of significant findings ($F = 4.587$ df 2,423 $p < .05$) on N indicated that color recognition thresholds for different lengths of stimuli were different. Inspection of the means indicated that the longest stimuli could be recognized at a lower threshold than the shortest stimuli. Results are presented in Table 2.

Recognition Time (C) color

Significant results ($F = 82.67$ df 3,423 $p < .01$) indicated that subjects could recognize some colors at a lower threshold than other colors. The color red could be seen very easily ($\bar{x} = 0.128$) while the color yellow was hard to see ($\bar{x} = 0.272$). Subjects reported

TABLE 1

Summary of Analysis of Variance of Perceptual Color Recognition Threshold

Source of Variation	Sum of Squares	d.f.	Mean Squares	F
LENGTH (N)	.00054	2	.00027	4.72 *
error (NS)	.00102	18	.00006	
COLOR (C)	.0145	3	.0048	16.7 **
error (CS)	.0078	27	.0003	
TREATMENT (T)	.0014	3	.00047	4.53 *
error (TS)	.0028	27	.00010	
LENGTH X COLOR (NC)	.00053	6	.00009	1.78
error (NCS)	.00266	54	.00005	
LENGTH X TREATMENT (NT)	.00061	6	.00010	1.35
error (NTS)	.00409	54	.00008	
COLOR X TREATMENT (CT)	.00116	9	.00013	1.65
error (CTS)	.00634	81	.00008	
LENGTH X COLOR X TREATMENT (NCT)	.00071	18	.00004	0.613
error (NCTS)	.01050	162	.00007	

** $p < .01$ * $.01 < p < .05$

TABLE 2

Summary of Analysis of Variance of Perceptual Color Recognition Threshold - Pooled Estimate of the Error Variance

Source of Variation	Sum of Squares	d.f.	Mean Squares	F
LENGTH (N)	.00054	2	.00027	4.59 *
error	.02470	423	.00006	
COLOR (C)	.00014	3	.0048	82.67 **
error	.02470	423	.00006	
TREATMENT (T)	.00014	3	.00047	8.04 **
error	.02470	423	.00006	
LENGTH X COLOR (NC)	.00053	6	.00009	1.50
error	.02470	423	.00006	
LENGTH X TREATMENT (NT)	.00061	6	.00010	1.75
error	.02470	423	.00006	
COLOR X TREATMENT (CT)	.00116	9	.00013	2.21 *
error	.02470	423	.00006	
LENGTH X COLOR X TREATMENT (NCT)	.00071	18	.00004	0.68
error	.02470	423	.00006	

** $p < .01$ * $.01 < p < .05$

that the color yellow at times had a greenish tinge and they needed a longer exposure time to be certain that the color was yellow. Results are presented in Table 2 and Figure 1.

Recognition Time (T) treatment

Significant results ($F = 8.038$ df 3,423 p .01) were further analysed using a "t" test of significance. This test between taboo and neutral treatments was not significant ($R_4 = 0.02$, df 36) and indicated that subliminal perception was not present as hypothesized (See Table 2 and Figure 2). Significance resulted from patches treatment differing from the other 3 treatments.

Recognition Time (C) color x (T) treatment

The significant interaction ($F = 1.75$ df 9,423 $p<.05$) indicated that the recognition threshold for treatments was different for different colors. This may be verified by inspection of the plots of C x T (Figure 3). Results are presented in Table 2.

Experiment II (Perceptual Defense Color Naming Latency, CNL)

Latencies of color naming were analysed using a 3 x 4 x 4 x 5 repeated measures factorial analysis of variance. The grand mean was 0.89 sec.. A pooled estimate of the error variance was used in order to give a more powerful test of significance. Both the simple and pooled analysis are presented in Tables 4 and 5.

Color Naming Latency (C) color

Significant results ($F = 24.6$ df 3,2151 $p<.01$) indicate colors were named at different mean latencies. The means varied from red ($\bar{x} = 2.07$) to yellow ($\bar{x} = 2.39$). Results are presented in Table 5.

Color Naming Latency (N) length x (C) color

TABLE 3

Duncan's New Multiple Range Test Applied to the Differences between k= 4 Treatment Means - The Analysis of Variance for the Same Experiment is Given Table 1

Any two treatment means not underscored by the same line are significantly different.
Any two treatment means underscored by the same line are not significantly different.

---

	(1)	(2)	(3)	(4)	(5)
	A	B	C	D	Shortest Significant Ranges
Means	.0188	.0190	.0196	.0230	

A= TABOO B= NEUTRAL C= STROOP D= PATCHES (CONTROL)

A	.0188		.00028	.00083	.00427	R_2= .0167
B	.0190			.00055	.00399	R_3= .0176
C	.0196				.00344	R_4= .0182

	A	B	C	D

α Level of .05 d.f. = 4(10-1) = 36

TABLE 4

Summary of Analysis of Variance of Perceptual Defense Color Naming Latency (CNL)

Source of Variation	Sum of Squares	d.f.	Mean Squares	F	
LENGTH (N)	0.90	2	0.45	0.024	
error (NS)	6.58	18	19.1		
COLOR (C)	30.3	3	10.1	7.70	**
error (CS)	35.4	27	1.31		
TREATMENT (T)	1.35	3	0.45	1.24	
error	9.79	27	0.36		
DURATION (L)	19.3	4	4.83	3.39	*
error	23.5	36	0.65		
LENGTH X COLOR (NC)	6.83	6	1.14	1.77	
error (NCS)	34.8	54	0.64		
LENGTH X TREATMENT (NT)	3.04	6	0.51	1.50	
error (NTS)	18.2	54	0.34		
COLOR X TREATMENT (CT)	2.94	9	0.33	0.97	
error (CTS)	27.4	81	0.34		
LENGTH X COLOR X TREATMENT (NCT)	4.53	18	0.25	0.74	
error (NCTS)	55.1	162	0.34		
LENGTH X DURATION (NL)	3.97	8	0.50	1.22	
error (NLS)	29.2	72	0.41		
COLOR X DURATION (CL)	6.24	12	0.52	1.16	
error (CLS)	48.4	108	0.45		
LENGTH X COLOR X DURATION (NCL)	8.54	24	0.36	0.97	
error (NCLS)	79.1	216	0.37		
TREATMENT X DURATION (TL)	23.9	12	1.99	2.59	**
error (TLS)	82.9	108	0.77		
LENGTH X TREATMENT X DURATION (NTL)	7.64	24	0.32	0.89	
error (NTLS)	77.2	216	0.36		
COLOR X TREATMENT X DURATION (CTL)	26.5	36	0.74	1.63	**
error (CTLS)	146	324	0.45		
LENGTH X COLOR X TREATMENT X DURATION (NCTL)	20.4	72	0.28	0.88	
error (NCTLS)	209	648	0.32		

** $p < .01$ * $.01 < p < .05$

TABLE 5

Summary of Analysis of Variance of Perceptual Defense Color Naming Latency (CNL) - Pooled Estimate of the Error Variance of Table 4

Source of Variation	Sum of Squares	d.f.	Mean Squares	F	
LENGTH (N)	0.90	2	0.45	1.10	
error	883.5	2151	0.41		
COLOR (C)	30.3	3	1.01	24.6	**
error	883.5	2151	0.41		
TREATMENT (T)	1.35	3	0.45	1.10	
error	883.5	2151	0.41		
DURATION (L)	19.3	4	4.85	11.8	**
error	883.5	2151	0.41		
LENGTH X COLOR (NC)	6.83	6	1.14	2.78	*
error	883.5	2151	0.41		
LENGTH X TREATMENT(NT)	3.04	6	0.51	1.21	
error	883.5	2151	0.41		
COLOR X TREATMENT (CT)	2.94	9	0.33	0.80	
error	883.5	2151	0.41		
LENGTH X COLOR X TREATMENT (NCT)	4.53	18	0.25	0.61	
error	883.5	2151	0.41		
LENGTH X DURATION (NL)	3.97	8	0.50	1.21	
error	883.5	2151	0.41		
COLOR X DURATION (CL)	6.24	12	0.52	1.27	
error	883.5	2151	0.41		
LENGTH X COLOR X DURATION (NCL)	8.54	24	0.36	0.87	
error	883.5	2151	0.41		
TREATMENT X DURATION (TL)	2.39	12	1.99	4.84	**
error	883.5	2151	0.41		
LENGTH X TREATMENT X DURATION (NTL)	7.64	24	0.32	0.77	
error	883.5	2151	0.41		
COLOR X TREATMENT X DURATION (CTL)	26.5	36	0.74	1.79	**
error	883.5	2151	0.41		
LENGTH X COLOR X TREATMENT X DURATION (NCTL)	20.4	72	0.28	0.69	
error	883.5	2151	0.41		

**$p < .01$ * $.01 < p < .05$

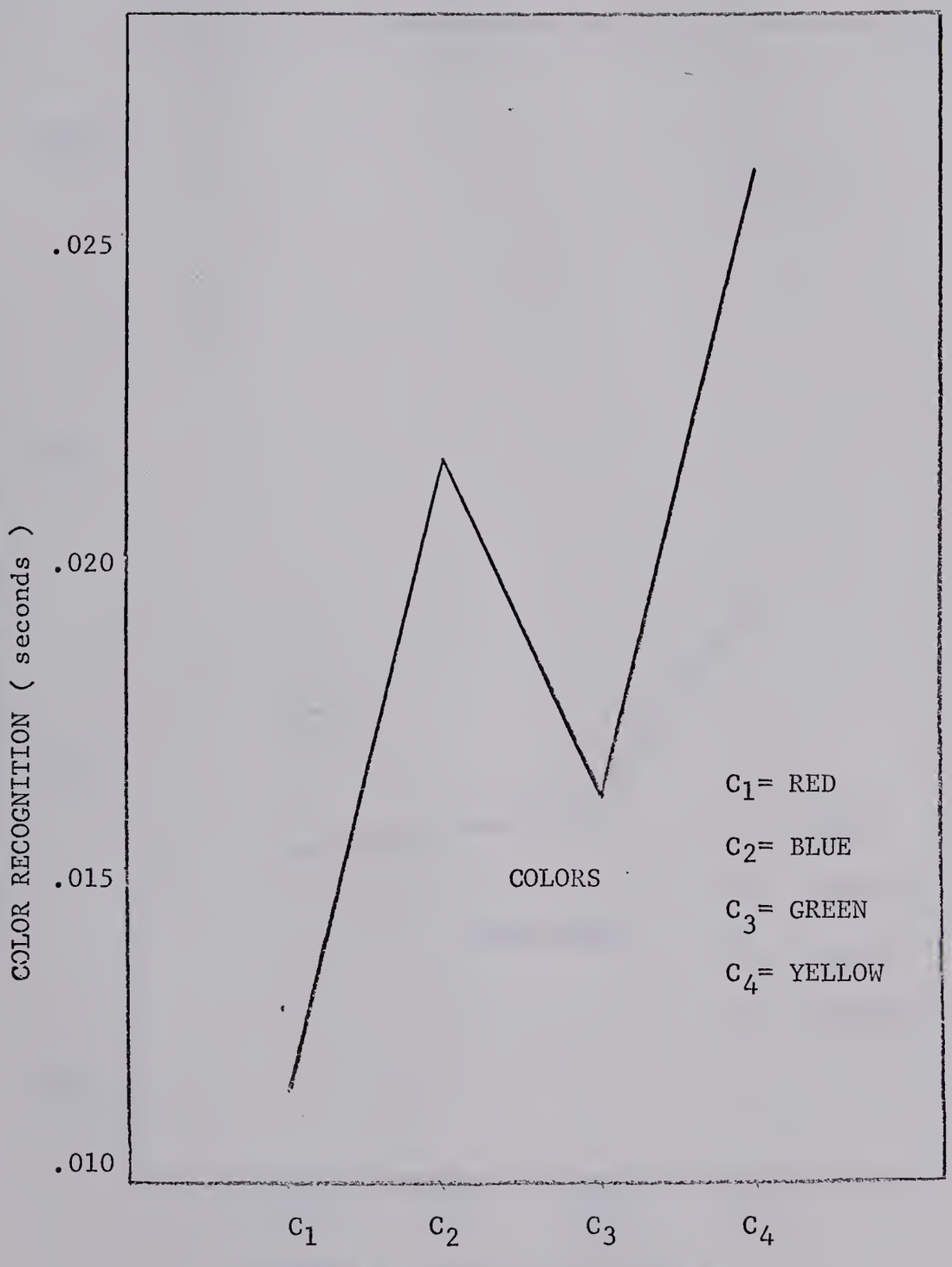

Figure 1. Recognition Time C
(Color Mean)

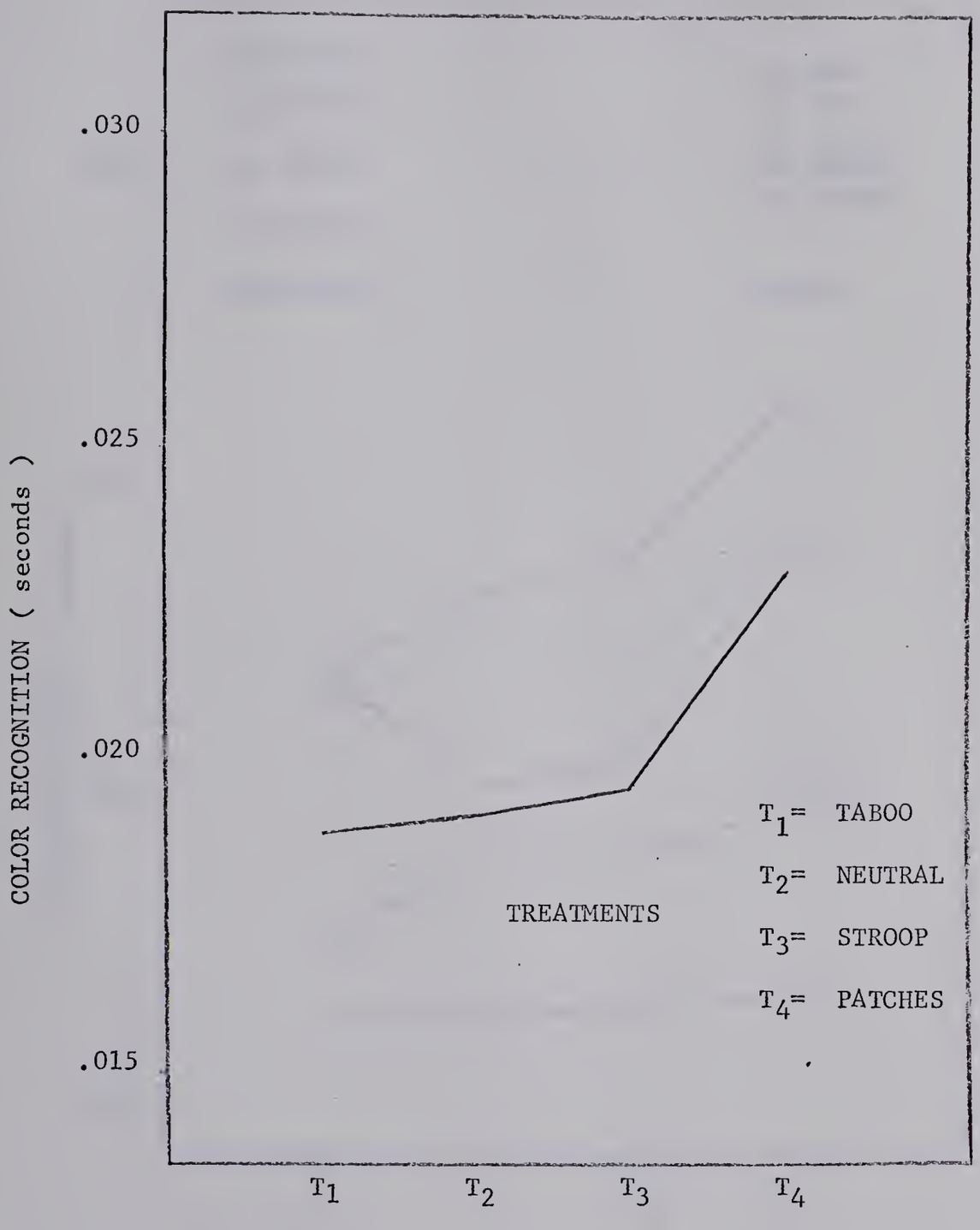

Figure 2. Recognition Time T
(Treatment Mean)

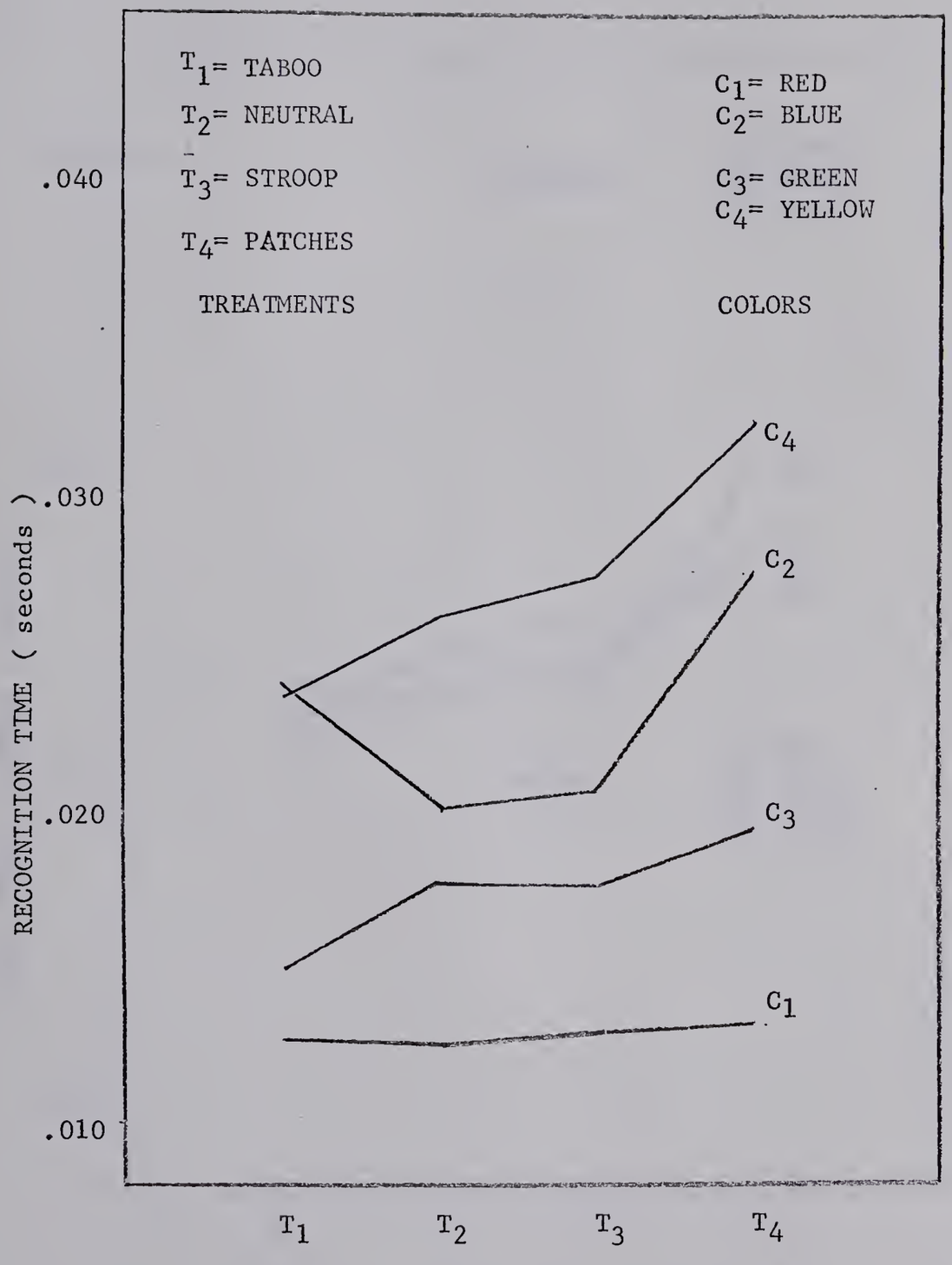

Figure 3. Recognition Time C X T
(Color X Treatment)

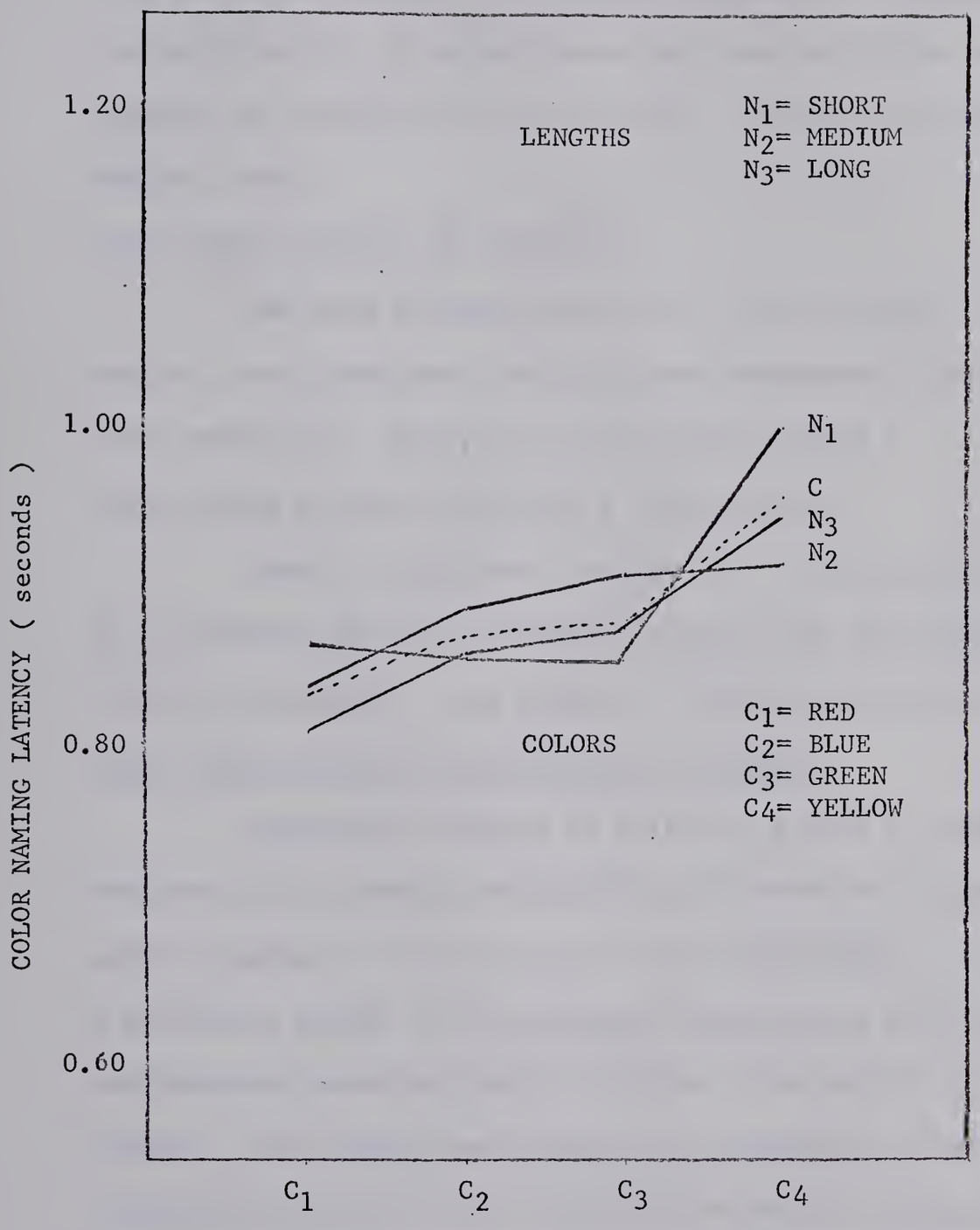

Figure 4. Color Naming Latency N X C
(Length X Color)

The significance of the NC interaction ($F = 2.78$ df 6,2151 $p < .01$) indicates that naming latencies for different stimulus lengths were different for different colors. See Figure 4. The naming latency for yellow stimuli of different lengths was different than for the other colors. No significance was found using the non-pooled analysis of variance ($F = 1.77$ df 6,54). Results are presented in Tables 4 and 5.

Color Naming Latency (T) treatment

The lack of significance ($F = 1.10$ df 3,2151) failed to uphold a main hypothesis that different treatments would yield different mean CNL's. Results are presented in Table 5.

Color Naming Latency (N) length x (T) treatment

Lack of significant results ($F = 1.21$ df 6,2151) indicates that different CNL's for different lengths were not different for different treatments. See Figure 5. Results are presented in Table 5.

Color Naming Latency (L) presentation duration

Significant results ($F = 11.8$ df 4,2151 $p < .01$) indicates that mean color naming latencies were different at different presentation durations. It would appear that latency times are affected in a non-linear manner by the different presentation durations. At a tachistoscope exposure time of 0.30 sec., the scores are maximally affected. The fastest mean latency was recorded for the 1.0 sec. presentation duration where full word and color information was available. Results are presented in Table 5 and Figure 6.

Color Naming Latency (C) color x (L) presentation duration

Lack of significance ($F = 1.27$ df 12,2151) indicates that different color CNL's do not differ at different presentation durations.

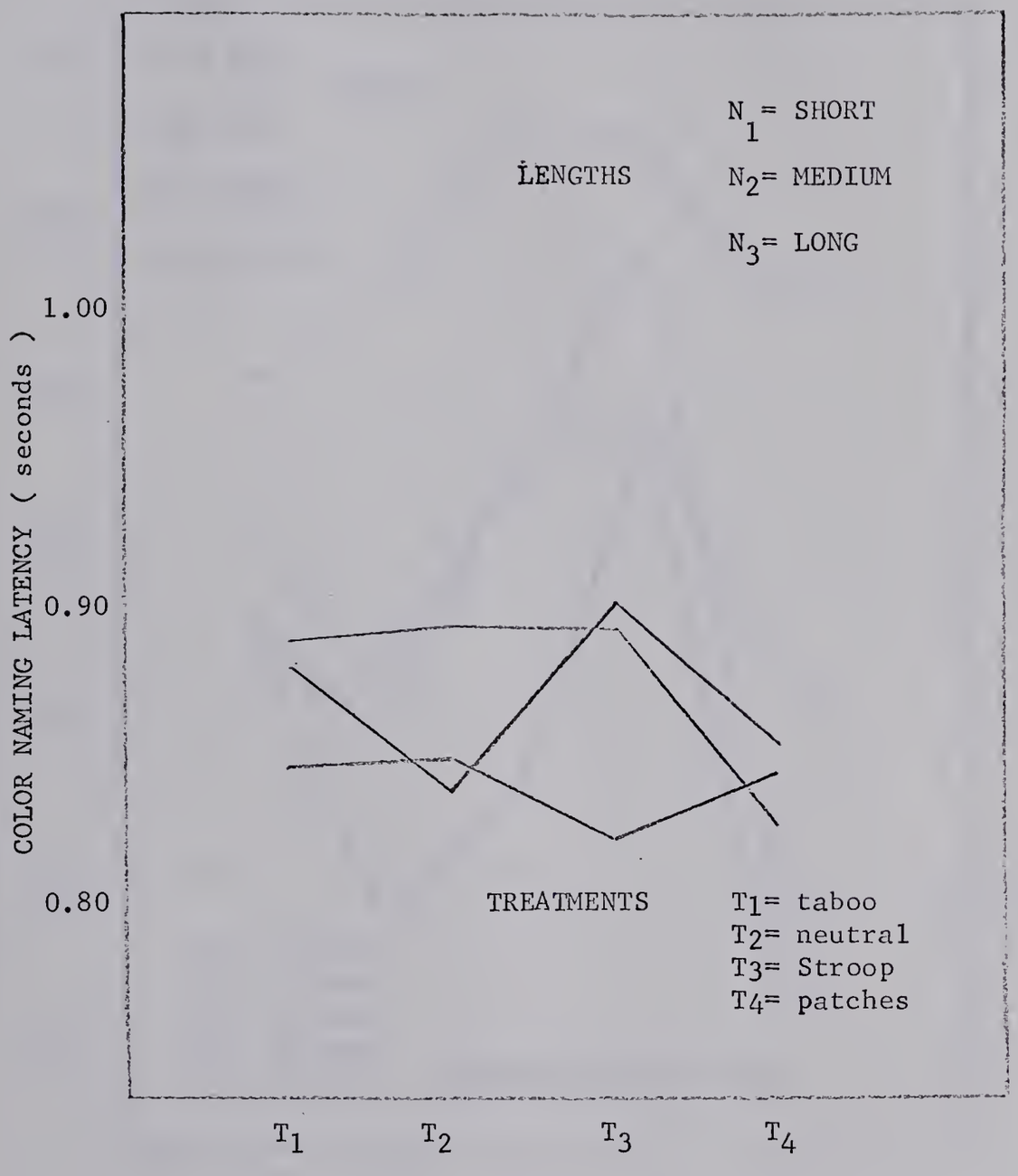

Figure 5. Color Naming Latency N X T
(Length X Treatment)

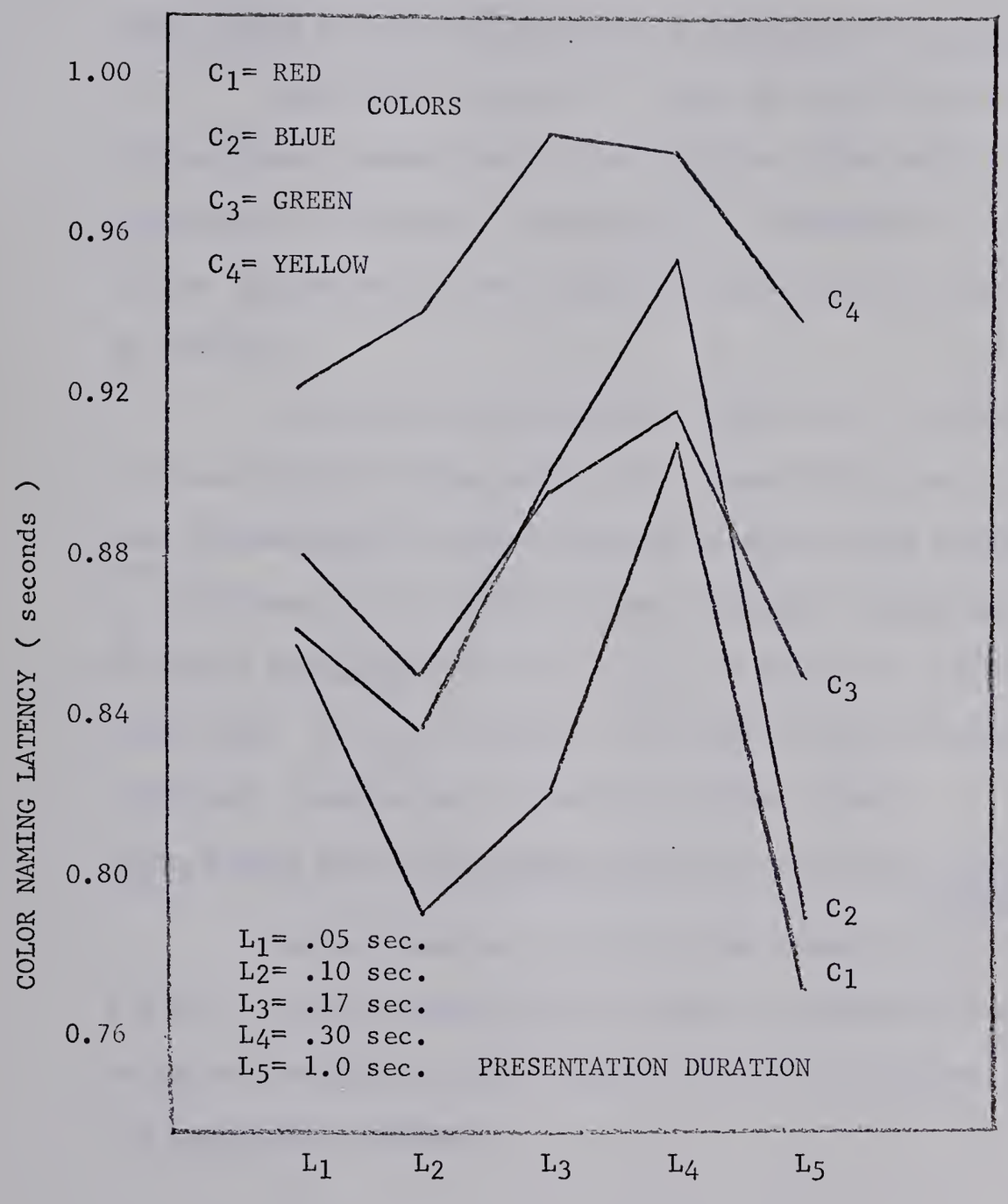

Figure 6. Color Naming Latency C X L
(Color X Presentation Duration)

Yellow mean CNL's differ slightly from the other color means by increasing in CNL from L_1 to L_2 (See Figure 6). Results are presented in Table 5.

Color Naming Latency (T) treatment x (L) presentation duration

Significant results ($F = 4.84$ df 12,2151 $p < .01$) indicates that subjects treated the treatment groups differently at different presentation durations (See Figure 7). Significant results ($F = 2.59$ df 12,108 $p < .01$) were also obtained using the simple analysis of variance.

At the first duration time (0.05 sec.), subjects gave the lowest CNL for taboo words. The trend of CNL for color patches over presentation durations differed from the other treatments. At L_2 (0.10 sec.), the CNL for taboo treatment stimuli increased while the other treatments did not. At L_4 (0.30 sec.), patches had the lowest CNL. At L_5 (1.00 sec.), the CNL's for the various treatments converged. Results are presented in Tables 4 and 5.

Color Naming Latency (C) color x (T) treatment x (L) presentation duration

The interaction of CTL was significant ($F = 1.79$ df 36,2151 $p < .01$). As this interaction is of minor importance to the study of perceptual defense, further analysis was not undertaken. Results are presented in Table 5.

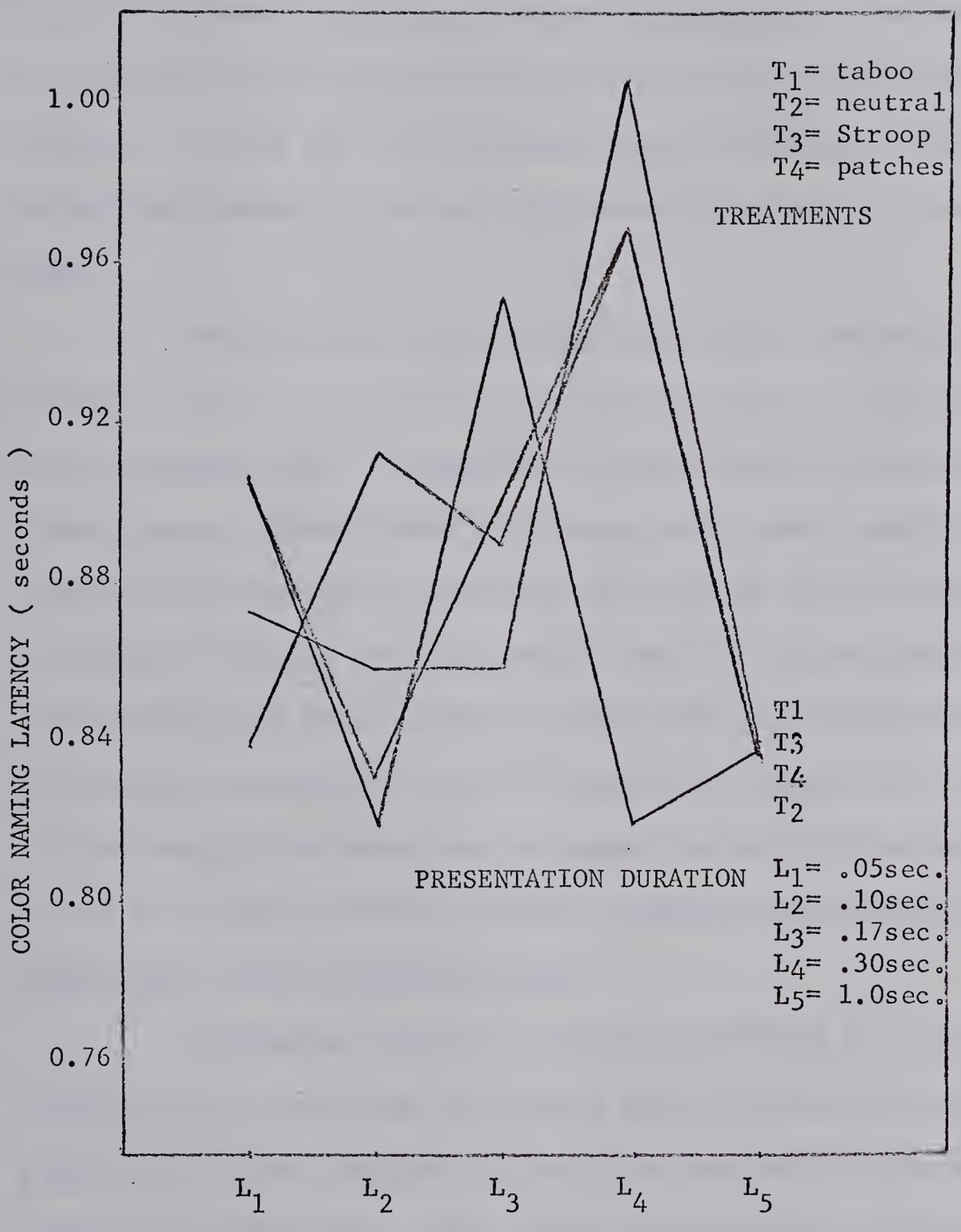

Figure 7. Color Naming Latency T X L
(Treatment X Presentation Duration)

INTERPRETATION OF DATA

It was originally intended that the four colors used in composing the word stimuli, would be equally visible and that they would be matched in luminance to their backgrounds. This was done so that subjects would recognize color at a lower threshold than the word stimuli. In this way the treatments could be analysed to see if word stimuli subliminally affected color recognition and color naming latency.

The four color mean recognition times (Experiment I) should have been equal. In an attempt to achieve this, the colors were masked with Letrafilm, until a lightmeter (calibrated to the human color visual system) showed their brightness to be nearly equal (See Results). Subjects were expected to recognize the various colors, at a common threshold. This was not found, which leads to the conclusion that the small differences that remained between colors was sufficient to cause differential recognition times of considerable magnitude. Experiment I color recognition means were not equal but varied from red (as easiest to see) to yellow (which appeared overmasked and hardest to see).

Experiment I Color Recognition Time

Subliminal perception would be indicated by a significant treatment effect with the taboo group being different from the neutral group. This would indicate that subjects reacted to words earlier than the word threshold. This effect was not noted however. Some subjects reported that certain stimuli "looked" different from other stimuli. It was noted at the time that they were referring to the color patches. They seemed to be trying to see words that did not exist. The patches then, did not serve as " controls "

for the other three treatment groups but gave the unexpected variation. This seemed to indicate subliminal perception. Further analysis using Duncan's Multiple Range Test, did not indicate that a significant difference existed between the means of taboo and neutral treatments. This then, does not support the major hypothesis of subliminal perception. It was further noted that the Stroop treatment did not exert interference in color recognition as would be expected if subliminal perception existed (Klein, 1964). Duncan's Multiple Range Test did not indicate that a significant difference existed between the Stroop and neutral means.

Color significance was the result of poor color matching. Red was too easily recognized while yellow was too hard to recognize. This variable could have been better controlled if experts had prepared the stimuli. In the interaction of CT, significance resulted as subjects recognized different colors in the treatments at different thresholds. Despite this, the interaction was unexpected as different colors should have been recognized at the same relative thresholds across the treatments.

The significant differences in means for N were expected as the color words were not matched for length.

Different lengths also contain different amounts of color aiding color recognition of certain stimuli over others. The shortest lengths were the most difficult to see while the longest lengths were easiest to see.

A more conclusive test of evidence for the existence or non-existence of subliminal perception using color recognition times will await stimuli that can be presented that have no brightness differences as are evidenced in this study.

Experiment II - Color Naming Latency

Evidence to support perceptual defense was not found. A significant difference was not detected between treatments. It was noted during data collection, that several subjects reported they could fixate on a certain area of the presentation field and thus avoid full word information. This effect was minimized due to the small field of view which the tachistoscope employed. It is believed that little loss of word information actually resulted as when looking at the corner of the presentation field, the word could still be read by the subject.

Non-significance in the analysis of the treatments may be the result of color information predominating over word information and masking the planned effects of interference and perceptual defense application. In this way, subjects may have been seeing primarily color and were not influenced by the word information contained on the cards. Supposedly, all treatments contained the same amount of color-information. If Stroop words do not differ from neutral words and patches, the assumption is that not enough verbal information was present to interfere with color recognition. This would explain why the Stroop category mean is nearly the same as the neutral category mean. Previous investigations (Klein, 1964 ; Jensen, 1965) showed that Stroop words cause more interference than neutral words. Color predominated in the taboo treatment, as evidenced by the taboo and neutral treatment means being the same. Subjects did not need to apply perceptual defense when seeing taboo stimuli, because they did not see them. Subjects responded only to color and all four treatments

displayed almost the same means.

Evidence for perceptual defense may be present in the different presentation duration means. Significant results indicate that subjects did not treat the stimuli in the same manner at different durations. At the first three presentation durations, color information seemed to predominate, allowing the subjects to say color at roughly the same CNL. At the presentation duration of 0.30 seconds (L_4) , enough word information must be present to cause subjects to be bothered by the interference effect. This causes verbal slowing, noted by increased CNL means. The supporting evidence for this theory comes from the significant interaction effect of TL. Here we note that color patches differ significantly from the other categories at L_4, in a direction that implies a lack of word information, resulting in a low CNL. As the other three categories contain word information, interference is offered, and they have a high CNL relative to color patches CNL.

Another interpretation of the analysis of L is as follows: At the largest presentation duration (L_5), subjects have time to separate the word from the color and name the color only. We would expect this, as the two stimuli are separate and distinct. The stimuli are then treated as such. This does not appear to be the case at L_4, as maximum interference is offered here. This results from color and word information showing equal prominance. This equality causes an interlocking effect of color-word that the subject must separate before reacting to color. She finds it necessary to assimilate two stimuli, but only to report one.

At L_1 in the TL plot (See Figure 7), taboo stimuli have

a lower CNL than the other treatments. As this presentation duration is above the word information threshold, subjects may be employing perceptual defense to guard against perceiving the words. At L_2, we may assume that something has changed. This change is due to an increased word information being available. Subjects cannot employ perceptual defense due to this increase. This is indicated by the presence of the taboo words. This was inferred from verbal comments on the "dirty" words that were present, even though a significant effect was not found among the treatments. Partial perceptual defense is indicated as the rise evident in CNL for the taboo words rises still further to a maximum at L_4. Subjects treat the neutral, taboo and Stroop treatments in the same manner, allowing word information to interfere. They would seem to read the words, treat them alike without employing perceptual defense, and then say the color seen. In this manner CNL rises for stimuli with word information. This cannot happen to color patches as color only is present. The CNL T_4, drops at L_4, while the other treatment CNL's rise.

Significant results in the analysis of color, indicate that the four colors were not said at the same CNL. There is no way to overcome this problem but a prelevel test should have been given to see if subjects say certain colors sooner than others. Future experiments should include these baseline values.

It may also be that in the present experiment, the colors were not matched evenly enough and certain color stimuli were brighter and stimuli reached the brain sooner for these colors than did

the other colors.

The color by treatment interaction did not yield a significant difference. This indicates that different colors were not treated differently for different treatments. This is in the direction expected as the treatment groups contain the same colors. Colors then, were matched fairly well across treatment groups.

In the interaction of color and presentation duration, a significant difference was not noted. From Figure 6, we note that colors have different CNL's at different duration speeds. L_2 has a lower CNL than L_1 as word information is lower than color information and little interference is offered by the words. C_4 is not affected in this manner due to the poor color masking of the yellow stimuli. CNL rises for yellow from L_1 to L_2 while the other colors CNL drop. All CNL's rise from L_2 to L_4, as color information is dominated by word information. Interference is then offered by the words. At L_5, the longest presentation, all CNL's drop. This would be due to the subject receiving equal amounts of both color and word information.

The following interactions were not significant: NTL, NCTL, NCT and NCL. As they have little relevance to this study, little need be said about them. The interaction of CTL was significant. This interaction bares little relevance to this study and will not be discussed here.

Criticisms must be levied against the apparatus and materials employed. The Farrall 3 field tachistoscope was the best instrument obtainable. Until very recently, tachistoscope speeds were hard to duplicate with adequate precision. As well, the field intensities could vary appreciably and this uneveness could have made some

stimuli easier to see than others. These effects were minimized in the present experiment but were still not totally absent. It was found that intensities could vary from day to day with the machine on the same brightness setting.

Conclusion

Following Spence's (1967) request for an experiment to look at both subliminal defense and perceptual defense, two interlocking experiments were conducted. 10 subjects were chosen at random from a nursing school and acted as their own controls.

Subliminal perception was not noted in Experiment I in the analysis of treatment groups. This was due to word information being overmasked. This allowed color information to reach the subject before word information did. In this way subjects could see too much color. Subliminal perception may be evidenced in Experiment I due to the subjects questioning the color patches. Color patches received the highest CNL as subjects looked for word formation even though this was not available. Therefore subjects saw the absence of words at an exposure duration below word threshold limits, which supports the subliminal perception theory.

Conclusive evidence to support the theory that perceptual defense can be shown in the laboratory, was not in evidence from Experiment II. Color overmasking and varying tachistoscope light intensities, combined to confuse and complicate the study of treatment groups at different presentation durations. Further analysis using better equipment and better stimulus materials, will have to be undertaken before conclusive evidence can be found to support the perceptual defense theory.

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APPENDIX A

INSTRUCTIONS

Experiment I

Stimuli printed in four different colors will be presented to you as a brief flash of color. The stimuli will be seen thru this viewer. Your task is to say the color you see when you can see it. The first several times, no color will be seen, but you are to concentrate on looking for the color. The four colors to be presented are: red, blue, green and yellow.

Press your face snugly into this rubber eye guard, as the colors will be easier to see if all possible outside light is excluded from the viewing field.

Are you ready then? Here is the first presentation.

Experiment II

Stimuli printed in four different colors will be presented to you as a brief flash of color. The colors are: red, blue, green and yellow. You will be able to see the words written in colors, but I want you to concentrate only on the color. Speak the color seen as quickly as you can when you see it. Speak easily enough that I can clearly understand the color you say. Please try to say only the color you see and not the word you see. Several words are actually color words, but these words are also in a color. The color, not the word, is what you must say. Please try to say the color only, and not a sentence such as; that is yellow, or it's blue.

Shall we begin then. Remember, say only the color seen, as quickly as you can when you see it.

APPENDIX B

RECORDING SHEET

(EXPERIMENT I AND II COMBINED)

Subject's Name:_____

Age:_____

Order Presentation Duration: (1= .05-1.0 sec. , 2= 1.0-.05 sec.)

ORDER OF PRESENTATION	STIMULI	color	RECOGNITION TIME # 1	DURATION CNL's # 2 1 2 3 4 5
	FUCK	red		
	CUNT	red		
	SHIT	red		
	COCK	blue		
	PRICK	blue		
	BITCH	blue		
	PENIS	green		
	VAGINA	green		
	BREAST	green		
	DOUCHE	yellow		
	BASTARD	yellow		
	CLITORIS	yellow		
	COOT	red		
	PIED	red		
	MACE	red		
	MULL	blue		
	BYLAW	blue		
	EXTOL	blue		
	GRIME	green		
	DOTAGE	green		
	ILLUME	green		
	OBTUSE	yellow		
	ACONITE	yellow		
	BARNACLE	yellow		
	BLUE IN RED			
	YELLOW IN RED			
	GREEN IN RED			
	RED IN BLUE			
	YELLOW IN BLUE			
	GREEN IN BLUE			
	BLUE IN GREEN			
	RED IN GREEN			
	YELLOW IN GREEN			
	BLUE IN YELLOW			
	RED IN YELLOW			
	GREEN IN YELLOW			
	RED PATCH	1		
	RED PATCH	2		
	RED PATCH	3		
	BLUE PATCH	1		
	BLUE PATCH	2		
	BLUE PATCH	3		
	GREEN PATCH	1		
	GREEN PATCH	2		
	GREEN PATCH	3		
	YELLOW PATCH	1		
	YELLOW PATCH	2		
	YELLOW PATCH	3		

APPENDIX C

SUMMARY OF RAW DATA

APPENDIX C

Summary of Raw Data

Experiment I

Color Recognition Time:

Means of N: (length)

N_1	N_2	N_3
0.021387	0.020100	0.018800

Means of C: (color)

C_1	C_2	C_3	C_4
0.012783	0.023033	0.017333	0.027233

Means of NC: (length x color)

	C_1	C_2	C_3	C_4
N_1	0.013400	0.026250	0.019250	0.026650
N_2	0.013350	0.021950	0.017450	0.027650
N_3	0.011600	0.020900	0.015300	0.027400

Means of T: (treatment)

T_1	T_2	T_3	T_4
0.018750	0.019033	0.01958	0.023017

Means of CT: (color x treatment)

	T_1	T_2	T_3	T_4
C_1	0.012733	0.012467	0.012867	0.013067
C_2	0.023867	0.020000	0.020667	0.027600
C_3	0.014800	0.017667	0.017600	0.019267
C_4	0.023600	0.026000	0.027200	0.032133

APPENDIX C cont'd

Means of NCT (length x color x treatment)

0.012600	0.012600	0.013000	0.029400
0.019800	0.022400	0.015600	0.013800
0.015000	0.023800	0.021200	0.025800
0.012600	0.014400	0.010400	0.021600
0.017200	0.021200	0.021600	0.017400
0.014000	0.027600	0.024200	0.026200
0.013800	0.014200	0.010600	0.023000
0.022000	0.017000	0.017800	0.019800
0.015200	0.023800	0.030800	0.027000
0.012200	0.012400	0.031000	0.014600
0.023000	0.022000	0.018800	0.028800
0.031400	0.034400	0.030600	0.017000

Means of S (subject)

0.018875	0.020083	0.018917	0.021083
0.019583	0.027167	0.01954	0.021083
0.012042	0.022583		

APPENDIX C

Summary of Raw Data

Experiment II

Perceptual Defense Color Naming Latency:

Means of N: (length)

N_1	N_2	N_3
2.2239	2.2193	2.1806

Means of C: (color)

C_1 (red)	C_2 (blue)	C_3 (green)	C_4 (yellow)
2.0749	2.1730	2.1984	2.3853

Means of T: (treatment)

T_1 (taboo)	T_2 (neutral)	T_3 (Stroop)	T_4 (patches)
2.2233	2.2171	2.2242	2.1671

Means of L: (presentation duration)

L_1 (.05)	L_2 (.10)	L_3 (.17)	L_4 (.30)	L_5 (1.00)
2.2022	2.1387	2.2524	2.3515	2.0948

Means of NC: (length x color)

	C_1	C_2	C_3	C_4
N_1	2.1056	2.1455	2.1433	2.5010
N_2	2.0940	2.2239	2.2686	2.2905
N_3	2.0251	2.1496	2.1832	2.3645

Means of NT (length x treatment)

	T_1	T_2	T_3	T_4
N_1	2.23	2.19	2.28	2.20
N_2	2.24	2.26	2.26	2.12
N_3	2.20	2.21	2.13	2.19

APPENDIX C cont'd:

Means of CT: (color x treatment)

	T_1	T_2	T_3	T_4
C_1	2.1280	2.1080	2.0806	1.9831
C_2	2.2010	2.1277	2.1767	2.1867
C_3	2.2003	2.1886	2.2671	2.1375
C_4	2.3637	2.4440	2.3725	2.3612

Means of NL: (length x duration)

	L_1	L_2	L_3	L_4	L_5
N_1	2.23	2.25	2.18	2.26	2.20
N_2	2.30	2.14	2.23	2.24	2.20
N_3	2.18	2.12	2.20	2.15	2.26

Means of CL: (color x duration)

	L_1	L_2	L_3	L_4	L_5
C_1	2.1416	1.9792	2.0520	2.2711	1.9307
C_2	2.1570	2.0959	2.2514	2.3877	1.9730
C_3	2.2055	2.1247	2.2427	2.2917	2.1274
C_4	2.3087	2.3548	2.4635	2.4554	2.3482

Means of TL: (treatment x duration)

	L_1	L_2	L_3	L_4	L_5
T_1	2.0888	2.2803	2.2238	2.4212	2.1021
T_2	2.1848	2.1492	2.1492	2.5148	2.0872
T_3	2.2675	2.0781	2.2577	2.4219	2.0958
T_4	2.2677	2.0470	2.3787	2.0480	2.0942

APPENDIX C cont'd:

Means of S:
(subjects)

2.2890	2.1732	2.1553	2.5849	2.5154
2.0355	2.3887	2.3639	1.9067	1.6667